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ANALYSIS OF THE INCOMPATIBILITY OF THE PRODUCT WITH FLUORESCENT METHOD

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The aim is to analyze the surface of the product (posterior bearing housing) with using the fluorescent method and to demonstrate the effectiveness of the sequence application like the fluorescent method and instruments of the quality management to analyze the incompatible of the product. In the production enterprise, during the fluorescent penetration test, the incompatibility was identified on the product (posterior bearing housing), i.e. the porosity cluster. The effective of the used the sequence containing the fluorescent method, the Ishikawa diagram and the 5Why method in order to identify incompatibility, and next the source cause was demonstrated. The analyze, the sequence of the methods and the proposed improvement actions can be used in other companies to analyze quality problems.

Keywords: nicel alloy, brarinc penetration fluorescent method, quality Ishikawa diagram

INTRODUCTION

The quality control of the products using non-destructive examinations, such as the penetration testing is a simple and quick way to detect non-compliance of the product. However, this method does not identify the cause of non-compliance. In this aim, it is possible to use the selected instruments of quality management, which like the penetration testing are simple, quick and not expensive methods. The instruments of quality management complement so can be used in the sequence way. The new way to use the sequence of the selected instruments of quality management (the Ishikawa diagram and the 5Why method) and the penetration method was proposed.

The effective of the used the sequence containing the fluorescent method, the Ishikawa diagram and the 5Why method in order to identify incompatibility, and next the source cause was demonstrated.

Characteristics of the penetration tests

In the penetration test, due to the liquid used, three methods are distinguished: color, fluorescent and color - fluorescent. The fluorescence method involves the use of the fluorescent penetrant to obtain a fluorescence phenomenon, through which it is possible to identify the incompatibility of the surface of the analyzed product. During the fluorescence method, it is necessary to use the UV lamp in a shaded workplace. By means of this method, it is possible to identify e.g.: fatigue cracks, grinding cracks or porosity.

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ANALYSIS

Characteristics of the AMS 5383

The material from which the product was produced and which was subjected to fluorescence penetration tests was the AMS 5383 nickel alloy. It is a heat-resistant and corrosion-resistant alloy. It is alloy of the 52,5 Ni, 19 Cr; 3,0 Mo, 5,1 Cb (Nb), 0,90 Ti - 0,60 Al, 18 Fe [1-4].

Aim of the study

The aim is to analyze the surface of the product (posterior bearing housing) with using the fluorescent method and to demonstrate the effectiveness of the sequence application like the fluorescent method and instruments of the quality management to analyze the incompatible of the product.

Subject of the study

The analyze of the fluorescence of the rear bearing housing used in the aircraft turbines.

Methodology

The defatted product was cooled to a maximum temperature of 40 °C and immersed in the MH-406 penetrant for 30 minutes, then it was immersed for 10 sec-

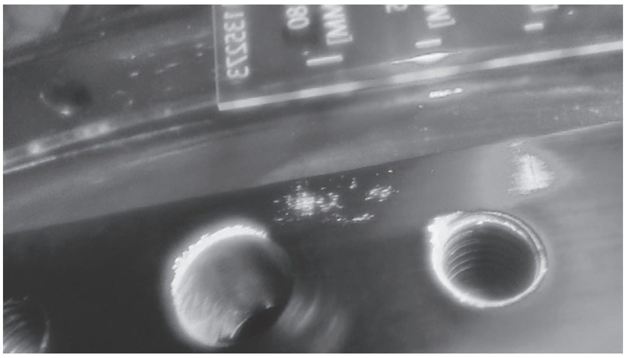

Figure 1 The fluorescence test result of the bearing back housing

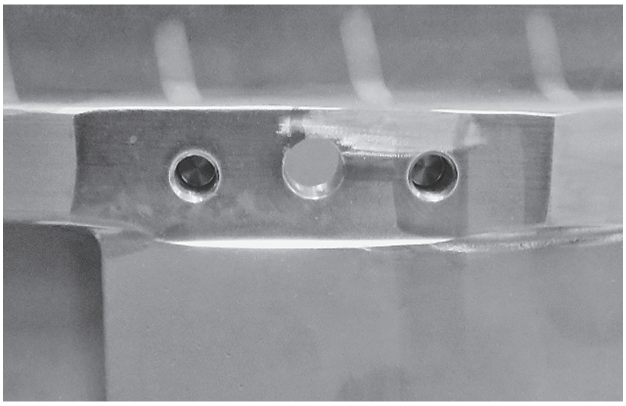

Figure 2 An example of the area of non-compliance on the back-bearing housing

onds in a pre-rinse bath before the final cleaning process. The fluorescent control of the part with HM-406 penetrant was performed according to internal instructions and ASTM E-1417 [5-7]. The sensitivity of the penetrant was checked using the TAM 146040 reference plate. The product was washed under a UV lamp using a water spray with a maximum temperature between 10 and 38 °C at a maximum pressure of 0,275 MPa, with direct spraying on the product from a minimum distance of 300 mm under lighting. The product was dried in a chamber dryer at a maximum temperature of 70 °C. On the surface of the product, a dry developer ZP-4B was applied in the form of a powder mist applied at an air pressure of maximum 0,172 MPa and a minimum developing time of 10 minutes. After a minimum of 10 minutes, the excess developer was removed using conjugated air with a maximum pressure of 0,034 MPa. The control was carried out in the control cabin under the UV lamp and the minimum radiation intensity of 1 200 μW/cm^2 on the surface, as well as at the light intensity in the cabin, which does not exceed 20 lux on the checked surface. After the inspection was completed, the product was washed in an aqueous solution to remove the developer and residues of other materials used during the inspection [8-12]. After identifying incompatibility on the product during the fluorescence control, steps were taken to identify the root cause of the problem.

For this aim, the quality management instruments were used, i.e. the Ishikawa diagram and the 5 Why

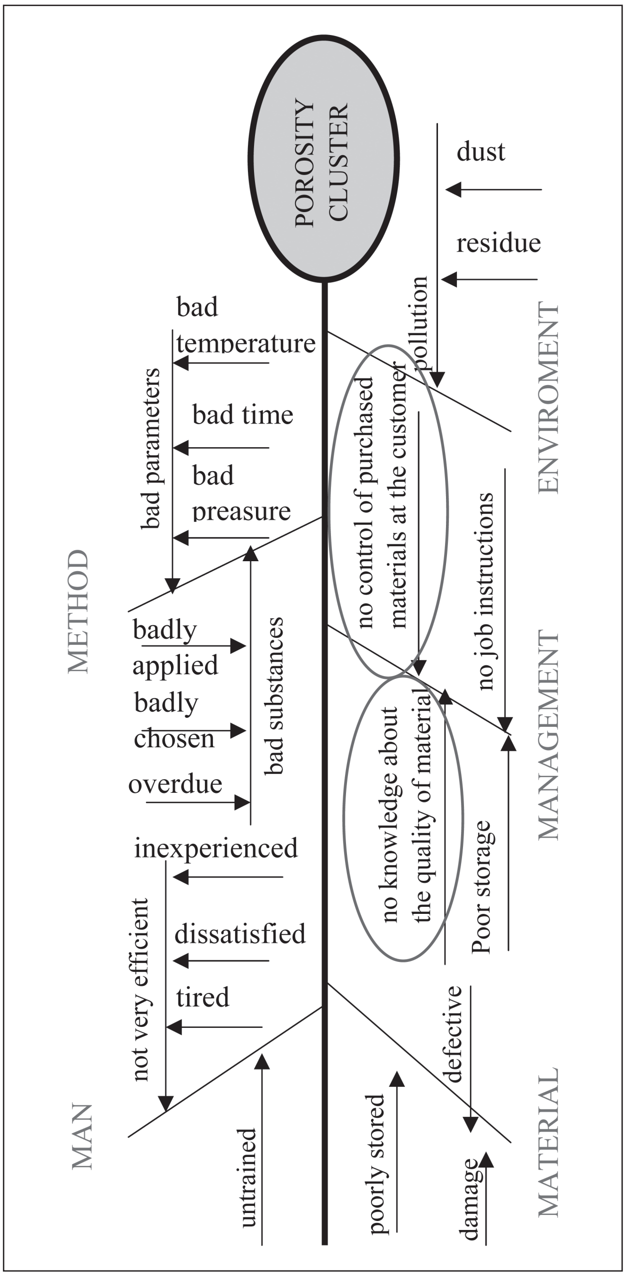

Figure 3 The Ishikawa diagram for the problem of porosity concentration on the product

method. The Ishikawa diagram was made to identify the potential causes of the problem. In the fish head the problem was noted (posterior bearing housing). Next, in order to the analyzed of the problem the basis categories of the Ishikawa diagram were selected (i.e. man, method, material, management and environment) [13-16]. From the indicated of the potential causes of the problem, the main causes were selected, so it was possible to made the further analyze to identify the source cause. The 5 Why method was used to identified the source cause of the occurrence of posterior bearing housing. The question “why” was asked until the answer was obtained, based on which it was possible to take the specific improvement actions [17-20]. After the identified of the source cause the improvement actions was proposed in purpose to eliminate or decrease the occurring of the problem.

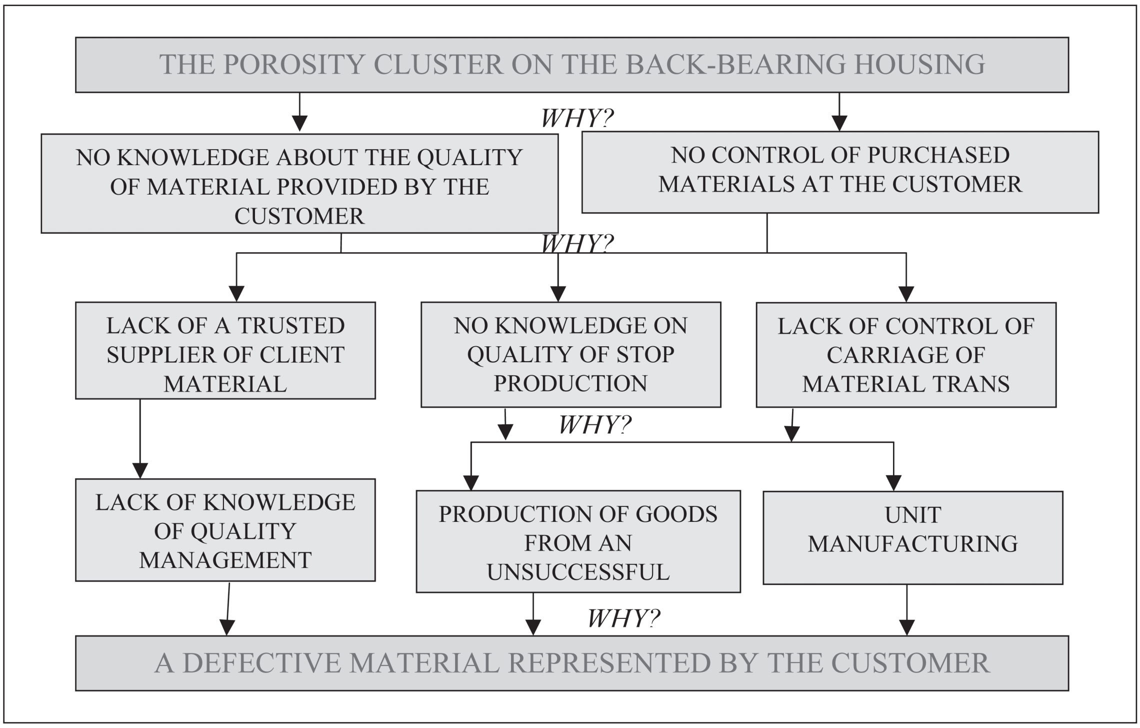

Figure 4 The 5Why method for the problem of the porosity cluster on the back bearing housing

RESULTS OF ANALYSIS

During the analysis of the product - the back bearing housing, using the fluorescence method the incompatibility which was found shown in Figure 1.

The cluster of the porosity of 0,540 inches on the external surface of the product was considered as incompatibility which shown in Figure 2.

The identified porosity cluster on the back-bearing housing was qualified as non-compliance due to exceeding the requirements according to the customer's acceptance standard as well as according to ASTM E-1417-16.

The using the fluorescence method used, it was possible to identify the product incompatibility. In order to identify the root cause of the incompatibility (i.e. the cluster of porosity on the surface of the product) the Ishikawa diagram and the 5Why method were used. The Ishikawa diagram is shown in Figure 3.

After drawing up Ishikawa diagram for the problem of the occurrence of porosity cluster on the product, it was concluded that the main causes of the problem were the lack of knowledge about the quality of materials provided by the customer, as well as the lack of control of materials provided by the customer.

To propose corrective actions aimed at eliminating the occurrence of nonconformities, the source cause of the problem should have been identified. For this purpose, a 5Why analyze was made, which is shown in Figure 4.

After analyzing the problem of the occurrence of the porosity cluster on the back bearing housing, it was concluded that the source material was the faulty material entrusted by the customer.

The product was made of AMS 5383 nickel alloy, the customer did not check the material receipt. Due to the subsequent control of the finished product by the fluorescent method, the incompatibility was detected that exceeded the permitted parameters contained in the internal instructions and in the ASTM E-1417 manual.

It was proposed that the client would establish good relationships with regular material suppliers. The good relations with the material supplier can ensure good quality of material, no delays in suppliers, lower purchase prices of materials, as well as avoiding additional costs associated with the creation of incompatibility products.

CONCLUSION

The use of fluorescence penetration testing proved to be effective and allowed to identify the incompatibility of the porosity cluster on the back of the turbine bearing housing. Application of the Ishikawa diagram made it possible to identify potential causes and select the root causes of the problem. The use of the 5Why method allowed to identify the source cause of the occurrence of the porosity cluster. The proposed sequence of the fluorescence method, the Ishikawa diagram and the 5Why method proved to be effective and made it possible to identify the incompatibility and, in turn, its source cause, which was the defective material. The analyze, the sequence of the methods and the proposed improvement actions can be used in other companies to analyze quality problems.

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